REMARKS

Claims 27 to 57 as set forth in Appendix II of this paper are now pending in this case. Claims 27, 29, 41, 49, 50 and 53 have been amended, and Claims 56 and 57 have been added, as indicated in the listing of the claims.

Accordingly, applicants have deleted references to particular embodiments in Claims 27 and 41 and have added new Claims 56 and 57 drawn to the deleted matter. Claim 29 was amended to avoid antecedent basis problems. Further, applicants have revised Claim 49 to refer to --an absorbent-- instead of a solvent,[2] and have amended Claims 50 and 53 to depend upon Claim 49 instead of Claim 27. No new matter has been added.

Additionally, applicants have corrected a typographical error on page 26 of the application, and have shortened and revised the abstract, as suggested by the Examiner.

The Examiner objected to the specification for reciting the abbreviation "BSA" without setting forth a suitable definition thereof. It is respectfully submitted that the occurrence of the abbreviation in the specification is due to an obvious typographical error. As explained by applicants in connection with Example 2:[3] "*The reactant used is the reaction effluent of the MA hydrogenation of Example 1 from which more than 50% of the SA content have been removed by partial condensation.*" This statement corroborates that the reaction effluent obtained in Example 1 which is described on page 6, indicated line 4 et seq., of the application, contained SA, and that the product which was erroneously designated as BAS was, in fact, SA. Applicants amendment corrects this error and withdrawal of the Examiner's objection is therefore respectfully solicited.

It is further respectfully requested that the Examiner withdraw the objection to applicants' abstract in light of the revised version which is herewith submitted. Favorable action is solicited.

The Examiner rejected Claims 29 and 50 to 53 under 35 U.S.C. §112, ¶2. Applicants have revised the claim language to obviate the Examiner's reasons for finding the claims indefinite. Withdrawal of the respective rejection is therefore respectfully solicited.

Further, the Examiner rejected Claims 27 to 30, 32 to 29, 41, 45, 48, 54 and 55 under 35 U.S.C. §103(a) as being unpatentable in light of the teaching of ***Budge et al.*** **(US 5,196,602)** when taken alone or when taken in view of the disclosure of ***Küksal et al.*** **(Applied Catalysis A:** *General 228, 237-251 (2002)*). The Examiner asserted in this context that the difference between applicants' invention and the teaching of ***Budge et al.*** resided in the fact that the reference "*does not specifically teach the removal of succinic anhydride or the specific temperatures, pressures, and concentration ranges listed in the claims. Also, Budge et al does not recite the use of shaft or tube and bundle type reactors.*"[4]

2) Cf. page 13, indicated line 11 et seq., of the application.

3) Cf. page 27, indicated line 5 et seq., of the application.

4) Office action page 5, lines 1 to 3.

It should further be noted, however, that applicants' invention requires that each of the hydrogenation stages, ie. steps (a) and (c) of Claim 27, be conducted *"using a catalyst which is free from chromium which comprises ≤ 95% by weight of CuO, and ≥ 5% by weight of an oxidic support."*[5] The teaching of ***Budge et al.***, taken alone or taken in view of the disclosure of ***Küksal et al.***, fails to suggest this particular element of applicants' invention and the reference(s) is(are) therefore not suited to establish that applicants' invention is unpatentable under the provisions of Section 103.

When applying 35 U.S.C. 103, it is inter alia necessary that the references be considered as a whole, that the references suggest the desirability and thus the obviousness of making the claimed combination, and that the references be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention.[6] By the same token, in determining obviousness the decision-maker has to return to the time at which the invention was made.[7]

The teaching of ***Budge et al.*** pertains to a procedure in which maleic anhydride is hydrogenated *"in the presence of ruthenium-containing hydrogenation catalysts."*[8] More specifically, the reference describes a two stage process in which:[9]

a) in a first stage, maleic anhydride or acid is hydrogenated to succinic anhydride, succinic acid, γ-butyrolactone or mixtures thereof in the presence of a hydrogenation catalyst,[10] and

b) in a second stage, succinic anhydride, succinic acid, γ-butyrolactone or a mixture thereof is hydrogenated to 1,4-butanediol in the presence of a hydrogenation catalyst of formula

$$Ru_{0.001-2}M_{0.001-2}M'_{0.001-2}M''_{0.001-1}O_x$$

in which **M** represents Ni or Pd, **M'** represents Fe, Co, Rh, Os, Ir or Pt, and **M"** represents Zn or Cd.[11]

The hydrogenation catalyst which is employed in the first of the two stages of the prior art process *"may be any hydrogenation catalyst which will effect the conversion of maleic anhydride to succinic anhydride,"* and representatives of such catalysts include, inter alia, *"mixed oxide catalysts comprising copper, zinc and aluminum."*[12] Such catalysts are, however, clearly not taught or suggested by the reference for the second stage hydrogenation reaction.

Applicants' invention is, therefore, not only distinguished from the procedure of ***Budge et al.*** by the features mentioned by the Examiner but also due to applicants' requirement that each of the

5) Cf. Claim 27, last subsection.

6) *Hodosh v. Block Drug Co., Inc.*, 786 F.2d 1136, 1143 n.5, 229 USPQ 182, 187 n.5 (Fed. Cir. 1986).

7) E.g. *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 USPQ2d 1434 (Fed. Cir. 1988), cert. denied, 488 U.S. 825 (1988); *Gilette Co. v. S.C. Johnson & Son, Inc.*, 919 F.2d 720, 16 USPQ2d 1923 (Fed. Cir. 1990).

8) Col. 1, indicated lines 6 to 13, of ***US 5,196,602***.

9) Col. 1, indicated lines 46 to 68, of ***US 5,196,602***.

10) See also col. 2, indicated lines 44 to 56, of ***US 5,196,602***.

11) See also col. 2, indicated line 56, to col. 3, indicated line 27, of ***US 5,196,602***.

12) See also col. 2, indicated lines 50 to 56, of ***US 5,196,602***.

hydrogenation stages of applicants' process be conducted in the presence of "*a catalyst which is free from chromium which comprises ≤ 95% by weight of CuO, and ≥ 5% by weight of an oxidic support.*" A person of ordinary skill in the art who had the reference before him and who had no knowledge of applicants' invention finds nothing in the teaching which suggest or even implies the desirability to to use "*any hydrogenation catalyst which will effect the conversion of maleic anhydride to succinic anhydride,*" not only in the first stage of ***Budge et al.***'s procedure but also in the second stage thereof. The reference therefore also fails to motivate a person of ordinary skill in the art to employ the particular catalysts referenced in applicants' claims in both hydrogenation stages.

As explained in MPEP §2143, three basic criteria have to be met in order to establish a *prima facie* case of obviousness:

(1) There must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings,

(2) there must be a reasonable expectation of success, and

(3) the prior art reference or the combined references must teach or suggest all of the claim limitations.

Additionally, the teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art and cannot be based on the applicant's disclosure.[13)]

These basic criteria are clearly not met where the teaching of ***Budge et al.*** and applicants' invention are concerned. The Examiner's position that applicants' Claims 27 to 30, 32 to 29, 41, 45, 48, 54 and 55 were unpatentable under 35 U.S.C. §103(a) in light of the teaching of ***Budge et al.*** when taken alone is, in light of the foregoing, not deemed to be well taken, and withdrawal of the respective rejection is respectfully solicited.

The disclosure of ***Küksal et al.*** is not suited to provide any information which would have reasonably motivated a person of ordinary skill in the art to effect the changes in ***Budge et al.***'s procedure which are necessary to arrive at applicants' invention.

The Examiner argued that the disclosure of ***Küksal et al.*** showed the desirability of suppressing the occurrence of succinic anhydride in the first hydrogenation step and that a person of ordinary skill in the art would therefore have been motivated to remove succinic anhydride before the second hydrogenation stage.[14)] The respective rationale is, however unsuited to motivate a person of ordinary skill in the art to effect the change in the catalyst employed in the second step of ***Budge et al.***'s proce-

13) *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438, 1442 (Fed. Cir. 1991).

14) Office action page 7, lines 7 to 14.

dure and a person of ordinary skill in the art who followed the rationale underlying the Examiner's argument would therefore not arrive at applicants' invention.

It should also be noted that succinic anhydride is a mandatory link in the chain of intermediates of the liquid phase hydrogenation, as is illustrated in Figure 1 of the ***Küksal et al.*** Accordingly, when the authors recommend that the occurrence of succinic anhydride be suppressed to avoid the referenced problems in the liquid phase hydrogenation this cannot reasonably suggest or imply a *removal* of the mandatory intermediate. Rather, the disclosure aims at increasing the rate at which succinic anhydride is converted to γ-butyrolactone thereby avoiding an accumulation of the intermediate in the reaction mixture and limiting the occurrence of undesired side reactions.[15] The Examiner's position that a person of ordinary skill in the art would have been motivated by the statements of ***Küksal et al.*** to add a step in which succinic acid is removed from the reaction mixture is, therefore, not deemed to be well taken.

In addition to the foregoing considerations a person of ordinary skill in the art having the references before him would also duly appreciate that the method addressed in the disclosure of ***Küksal et al.*** and the procedure described by ***Budge et al.*** differ significantly in pertinent aspects.

The disclosure of ***Küksal et al.*** pertains to a method wherein the consecutive hydrogenations[16] are conducted in one three-phase slurry reactor, ie. the reaction mixture contains both catalysts at the same time. As shown in Figure 6 of ***Küksal et al.*** this also means that the reaction mixture contains certain amounts of all intermediates and the final product at the same time. Such conditions are clearly not prevalent in the two-stage procedure of ***Budge et al.*** in which the a first hydrogenation step and a second hydrogenation step are conducted in separate reactors or reactor zones. Additionally, the catalyst which is provided in the reaction mixture of ***Küksal et al.***'s method to promote the hydrogenation of succinic anhydride is distinctly different from the ruthenium-containing catalyst which is used in the second stage of ***Budge et al.***'s procedure. These differences further emphasize why a person having ordinary skill in the art would not have applied the information pertaining to the "one pot" method of ***Küksal et al.*** when contemplating possibilities to modify the two-stage procedure of ***Budge et al.***

The three basic criteria for establishing a prima facie case of obviousness are therefore also not met when the teaching of ***Budge et al.*** is considered in view of the disclosure of ***Küksal et al.*** The Examiner's rejection of Claims 27 to 30, 32 to 29, 41, 45, 48, 54 and 55 under Section 103(a) in light of the respective combination of references should, therefore, be withdrawn. Favorable action is respectfully solicited.

15) Cf. e.g. Figure 6 of ***Küksal et al.***

16) Cf. Figure 1 of ***Küksal et al.***